Appl. No.: 10/051,623
Amdt. Dated: 02/05/2004
Off. Act. Dated: 09/05/2003

REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendments and discussion presented herein.

1. Rejection of Claims 49-82 under 35 U.S.C. §112, second paragraph.

The Examiner rejected Claims 49-82 under 35 U.S.C. §112, second paragraph, as being indefinite for the stated reason that the claims fail to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In this regard, the Examiner indicated that the scope of the term "acceptor centers" was confusing.

In response, the Applicant apologizes for any confusion, but respectfully traverses the rejection and submits that the terms "acceptor center" and "acceptor centers" are clearly described in the specification.

For example, referring to page 4, lines 9-11 of the Specification, the Applicant states that "It has also been observed that atoms that act as acceptor centers in semiconductor materials tend to attract and condense injected ions near the acceptor centers location in the material." Later, at page 7, lines 8-18, Boron is given as an example of a getter material that can be used to form acceptor centers in silicon for collecting Hydrogen atoms. Other getter/ion combinations known in the art can be used as well. From these portions of the specification, it should be clear that an acceptor center is an area in a material that form by injection of a getter and which will collect introduced atoms.

In the prior office action response, the Applicant differentiated these acceptor centers from the teachings of Henley et al. (US Patent No. 6,162,705). Henley et al. describes injecting "energetic particles (e.g. charged or neutral molecules, atoms, or electrons having sufficient kinetic energy) through the surface, where the particles are at a relatively high concentration to define a thickness of donor substrate material..." (see, col. 2:39-44). Henley et al. introduces particles at a specific depth in sufficiently high concentrations to form a weakened plane so that the wafer can be split through the

weakened plane. According to this process, the weakened plane must be formed directly in response to this high density bombardment. However, Henley et al. does not teaching the formation of a material having acceptor centers to which hydrogen or other atoms are diffused.

By contrast, the Applicant introduces a first type of atom, referred to as a getter or acceptor, to which a second type of atom is attracted to, in particular during the diffusion or drift of the hydrogen to the acceptor center (i.e., the location of the acceptors in the material). The second atomic species is drawn to the acceptor centers resulting in the formation of a weakened region having a contour that follows the acceptor center locations. As indicated above, one example of these pairs are an activated Boron acceptor to which Hydrogen is diffused to form a weakened cutting plane.

This can also be stated as a method of ion split cutting which involves introducing atoms (i.e. Hydrogen) into solid materials at a first location, and then diffusing the atoms to getter/acceptor centers, which were formed by introducing acceptors into a region of the material, such as those forming a cutting plane across the solid material. The resulting weakening at the cutting plane allows the solid material to be split, thereby providing a means for expunging a layer from a material, such as for removing a device layer.

An example is given in Applicant's Specification at page 8, lines 8-22 as follows: "Referring first to FIG. 1, in accordance with the present invention, a conventional getter material such as Boron is used to form and selectively introduce acceptor centers into a solid substrate material 10, such as silicon, using conventional techniques. In order to activate the acceptor sites and reduce any damage associated with their introduction, a high temperature rapid thermal anneal of over approximately 900°C for a short period of time such as less than approximately 1 minute. The introduction of these acceptor centers 12 defines a "getter surface" 14 in the substrate material. Next, an ion implantation step is carried out. Atoms 16, such as hydrogen atoms, are introduced

into the substrate material, also using conventional techniques, such that the location of the major concentration of the acceptor centers is offset spatially by the range-energy considerations of the atoms introduced into the substrate".

It should also be noted that acceptors are implanted into the material according to the present invention at lower concentrations (less damaging) than the atoms being implanted to form a cutting plane according to the teachings of Henley et al. The material of the present invention having acceptor centers is not subject to splitting and bubbling before the acceptors are activated and Hydrogen is introduced and diffused to the activated acceptor.

The Applicant is also confused by the Examiner's statement: "Now, it seems, based on applicant's arguments that there is no mention of "acceptor centers" in the hydrogen-trapping-sites disclosure of Henley et al., there must be a special definition of "acceptor centers" for applicant's claimed invention...".

In this regard, the Examiner refers to the "hydrogen-trapping-sites disclosure of Henley et al." However, Henley et al. makes no reference to "trapping sites" at all. The word "trapping" is not even found in the Henley et al. patent. Henley et al. describes implanting particles to a specified depth to create a weakened plane, but there is no hydrogen trapping. Furthermore, Henley et al. describes these particles as "hydrogen gas, helium gas, water vapor, methane, and hydrogen compounds, and other light atomic mass particles" and describes their use as follows: "Effectively, the implanted particles add stress or reduce fracture energy along a plane parallel to the top surface of the substrate at the selected depth."

In contrast, the "acceptors" of the Applicant's invention comprise a first species of material which are selected for collecting a second species of material. The first species (acceptors) are implanted to a depth to form an acceptor center. The second species is introduced and diffused or drifted to the acceptor centers from a location spaced apart from the location of acceptor center. A sufficiently weakened plane to split the material is formed after collecting of the second material (typically Hydrogen) at

the first material (e.g., an acceptor such as Boron after activation). It should be understood that the form of acceptor depends on the species of the second material and the material into which the second material is diffused. For example, in one embodiment, Boron acceptors are used for collecting hydrogen within a silicon wafer. Other combinations (e.g., gallium acceptors for use in trapping hydrogen in Si) can be used as well.

It should also be recognized from the Applicant's Specification that the implanted first species (e.g., Boron) does not operate as an "acceptor" until it has been activated. Before activation is does not "accept" Hydrogen. Referring to Page 11, lines 16-19 of the specification, the Applicant states: "The importance of the RTA of the boron in our experiments is not known, but may be important in the light of the ionized donor argument just described, since without the RTA the boron would not be expected to be electrically active and act as an ionized acceptor."

Therefore, the Applicant respectfully submits that the terms "acceptor center" and "acceptor centers" are clearly defined in the Specification and should not be considered confusion. Accordingly, the Applicant respectfully requests that the rejection be withdrawn.

2. Rejection of Claims 49-82 under 35 U.S.C. §102(e).

Claims 49-82 were rejected under 35 U.S.C. §102(e) as being anticipated by Goesele et al. (U.S. Patent No. 5,877,070). Claims 49, 57, 64, 70, and 75 are the independent claims within this group of rejected claims.

In order to expedite prosecution of this application, the Applicant has amended the independent claims to recite the "non-planar contour" indicated by the Examiner to constitute allowable subject matter. More particularly, the Applicant recites that the layer "has a surface with a non-planar contour defined by the relative positions of a plurality of acceptor centers". Such amendment is without disclaimer of the original subject matter of the claims and is without prejudice to filing a continuation application directed to that subject matter.

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Goesele et al. does not teach, suggest or provide motivation or incentive for a layer of material with the non-planar contour. Therefore, Goesele et al. does not anticipate or render obvious the subject matter of the Applicant's claims.

Accordingly, the Applicant requests that the rejection be withdrawn.

3. Conclusion.

In view of the foregoing, the Applicant respectfully submits that Claims 49-82 are in a condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

The Applicant also respectfully requests a telephone interview with the Examiner in the event that there are questions regarding this response, or if the next action on the merits is not an allowance of all pending claims.

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Respectfully submitted,

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